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ABSTRACT

A project studied a method to overcome possible embarrassment and "math anxiety" of secondary level students in remedial and special needs math classes and to sustain interest in drill practice while allowing for better utilization of the teacher's time. One Monroe Calculator "Classmate 88" programmed calculator was placed in each of five remedial math labs and one in a special needs math classroom. Prior to using the calculator for computation, students were given a pre-test in math and instruction in the use of the calculator. Upon completion of use, students were given a post-test, and comparison of means was made. Teachers and students were subjected to attitudinal surveys concerning reactions to the use of the calculator upon completion of the project. Despite the lack of significant gains in scores and a difference of only 0.8 in percentile means in favor of the experimental group, teachers have recommended continued use of the calculator. They cited its effectiveness as a motivator and its place in the curriculum as an aid in practice in basic computations, review to meet individual needs, and for math enrichment. Overall, students' attitudes were positive toward the use of the calculator and in their feelings of accomplishment in math. (Pre- and post-test results and survey instruments and results are appended.) (Author/YLB)

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ED193429

FINAL REPORT

OF

PROJECT:
EXPLORATION OF THE USE OF "PROGRAMMED" CALCULATORS IN REMEDIAL AND SPECIAL NEEDS MATH PROGRAMS AT THE SECONDARY LEVEL

1978-79

Middlesex County Vocational and Technical High Schools
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Project Director
Marie McDonnell
Supervisor of Instruction,
Related Subjects

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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Project Duration:

September 14, 1978
Beginning Date

June 15, 1979
Ending Date

The Contractors undertaking this project were encouraged to express fully their judgments in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official funding agency positions or policies.

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PROJECT TITLE: Exploration of the Use of "Programmed" Calculators in Remedial and Special Needs Math Programs at the Secondary Level

LEGAL NAME OF APPLICANT DISTRICT, INSTITUTION OR AGENCY: Board of Education for the Vocational Schools in the County of Middlesex

ADDRESS: 112 Rues Lane

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ABSTRACT

DESCRIPTION OF PROJECT

Priorities

(Federal Register, Vol. 42, No. 191, 104.708)

(A-2) "Development and dissemination of vocational education materials for: Handicapped persons; Disadvantaged persons (other than handicapped persons); Persons of limited English speaking ability."

(A-5) "Development and dissemination of other curriculum materials designed to improve the State's vocational education programs."

(B-1) "Improve the curriculum management of materials in vocational education on the local and/or state level. This includes new, changing and emerging occupations; individualized and competency-based instructional programs, and alternative delivery systems."

(Federal Register, Vol. 42, No. 191, 104-793)

(A-2) "Development of curriculum materials free of sex stereotyping."

Objectives

This proposal addressed itself to a method to overcome possible embarrassment and possible "math anxiety" of secondary level students in remedial and special needs math classes and to sustain interest in drill practice while allowing for better utilization of the teacher's time.

Objectives for this project were:(1) Students would show improvement in rote computational skills; (2) Students would have the feeling of accomplishment; (3) Students would have a positive attitude toward continued use of the calculator, in particular, and mathematics, in general; and (4) Teachers would react positively to continued use of the calculator as an instructional aid.

Procedures

Arrangements were made to lease and maintain six Monroe Calculator "Classmate 88" programmed calculators for one year. One calculator was placed in each of five remedial math labs and one in a special needs math classroom. The remedial specialists were responsible for supervising and scheduling student use and maintaining records and equipment; the supervisor of related instruction coordinated the program.

Teachers made an effort to have an equal number of boys and girls assigned to the calculators, where it was feasible. Prior to using the calculator for computation, students were given a pre-test in math and instruction in the use of the calculator. Upon completion of use, students were given a post-test, and a comparison of means was made.

Teachers and students were subjected to attitudinal surveys concerning reactions to the use of the calculator upon completion of the project. A final report incorporating this information and evaluating the project was made by the supervisor.

Conclusions

Despite the lack of significant gains in scores and a difference of only 0.8 in percentile means in favor of the experimental group, teachers have recommended the continued use of the calculator. They cite its effectiveness as a motivator and its place in the curriculum as an aid in such areas as practice in basic computations, review to meet individual needs, and for math enrichment. Overall, students' attitudes were positive toward the use of the calculator and in their feelings of accomplishment in math.

Dissemination and Contribution to Vocational Education

The final report will be made available to other schools upon request and visits to see the program in operation can be arranged with the supervisor of related instruction for the 1979-80 year.

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EXPLORATION OF THE USE OF "PROGRAMMED" CALCULATORS IN REMEDIAL AND SPECIAL NEEDS MATH PROGRAMS AT THE SECONDARY LEVEL

INTRODUCTION

PRIORITIES

This curriculum development proposal addressed itself to the following priorities:

(Federal Register, Vol. 42, No. 191, 104.708)

(A-2) "Development and dissemination of vocational education materials for: Handicapped persons; Disadvantaged persons (other than handicapped persons); Persons of limited English speaking ability."

(A-5) "Development and dissemination of other curriculum materials designed to improve the State's vocational education programs."

(B-1) "Improve the curriculum management of materials in vocational education on the local and/or state level. This includes new, changing and emerging occupations; individualized and competency-based instructional programs, and alternative delivery systems."

(Federal Register, Vol. 42, No. 191, 104.793)

(A-2) "Development of curriculum materials free of sex stereotyping."

PROBLEM

The concern of the State for students to meet at least minimum proficiency levels in basic computational skills is also the concern of vocational education where knowledge of math is essential for success in most career areas. As of July, 1977, the percentage of our students identified as performing below grade level in math was about 60% for the ninth grade, 47% for the tenth grade, and

37% for the eleventh grade. Basic skills improvement programs and remedial programs to correct the situation were instituted. The core of these programs consists of individualized drill and practice in the basic computational skills. The secondary school low achiever frequently resists remediation out of embarrassment or fear of failure. A method to overcome the fears and sustain student interest while releasing the remedial specialist from tedious tasks, such as correcting papers, so that she/he might be more effectively utilized, was needed.

As a possible solution to both aspects of the problem these math classes explored the use of a programmed calculator as a teaching device. It was hoped that the impersonality of the machine would help relieve the possible feelings of embarrassment, and the appeal of a new approach would offset fears and help towards sustaining interest. It was also hoped that females, who have had the tendency in the past to avoid mathematics, would develop positive attitudes toward math through the use of the calculator.

OBJECTIVES AND EVALUATION

The long-term objective was to overcome "math phobia" and to develop an instructional method to maintain interest in drill exercises associated with remediation for basic computational skills.

The short-term objectives to be met by the completion of the period of use were:

a. Students would show improvement in rote computational skills, as evidenced by comparison of a pretest and post-test mean.

b. Students would have the feeling of accomplishment, as evidenced by a student attitudinal survey.

c. Students would have a positive attitude toward the use of the calculator, in particular, and mathematics, in general, as evidenced by a student attitudinal survey.

d. Teachers would react positively to the use of the calculator as an instructional aid, as evidenced by a teacher attitudinal survey.

RELATED RESEARCH

Most of the research in the past ten years has found that calculators enhance learning or motivation or both. A comparative study in the Lincoln, Nebraska Public Schools concerning "Evaluation of the Monroe Classmate 88 Calculator," 1977, showed that one group's average increased from 61.1% to 86.9%, and their student survey showed that students enjoyed the use of calculators.

Broussard, Fields, and Reusswig, writing in AV Instruction (February, 1979), stated that, for low achievers from disadvantaged areas, a program which emphasized real world applications and use of flow charts, calculators and other material resulted in significant gain.

Longstaff, Stevens, and King, in their paper, "Desk Calculators in the Mathematics Classroom," (1968) found that calculators improved student attitude toward math. They also stated that calculators fit into the environment of the classroom and make the period more enjoyable for students.

Cech's 1972 research study observed that students could compute better with calculators than without them.

Caravella, writing for the National Education Association (1977), pointed out that the calculator provides "the kind of immediate feedback that reinforces learning...It is replacing flash cards and other drill materials." The programmed calculator, with its immediate feedback as to right or wrong answer, saves teacher time in that the teacher can spend less time in correcting papers.

Caravella's study also suggests that students who are mentally, physically, or educationally handicapped and cannot write as fast as others can counteract that limitation through the use of the calculator. Since calculators can convert symbolic terms into numerical equivalents, reading difficulties of low achieving or limited English speaking students may be reduced.

Gaslin's studies (Journal for Research in Mathematics Education. March, 1975) show that rote computational skills are significantly better when students use calculators.

The National Advisory Committee on Mathematics Education (NACOME), in its 1975 report, called for further research "concerning the uses of computing and calculating instruments in curriculum at all levels and their relationship to a broad array of instructional objectives."

FINAL REPORT

PROCEDURES: General Design, Management and Personnel

The proposed exploratory project did not require the use of additional personnel. Five remedial math teachers and one special needs math teacher, all presently employed, were involved. One other remedial and two other special needs teachers were involved with control groups.

The Monroe Calculator Company's "Classmate 88" calculator is available on a three-year educational-lease basis for less than $400.00 per year, with maintenance (the purchase price is about $750.00). The lease can be canceled at the end of the first or second year. About the size of a desk calculator, the machine contains over 70 hardwired programs which can accommodate individually prescribed instruction.

Students are able to operate the "computer" by themselves and control the pace of their practice. As part of the software accompanying the machine is a booklet with student achievement charts and placement tests, which direct the student to a particular program. The machine can be set to generate ten, twenty-five, or an unlimited number of problems in a particular program. The machine presents a problem on tape and then waits for a response; the student uses pencil and paper to figure out the answer, and then presses the appropriate keys. If the response is incorrect, the machine prints a red E and waits for another response. The student can try to answer again or can press a "bull's-eye" key and get the correct response (bull's-eye responses are duly identified for the teacher by the machine). The drill is terminated automatically after the set number of problems or when the SCORE key is pressed. The machine then prints out the number of problems attempted, number of correct answers, and the percentage correct.

The machine can also be used as a regular calculator with thirteen-digit capacity. For the project, the machine was used only in the programmed mode, but teachers were encouraged to experiment with it with students other than the tenth graders in the project. They reported that, in the calculator mode, it could be a useful aid in the curriculum for checking answers and assisting with problems involving more than one mathematical operation.

Arrangements were made by the school, through the supervisor of related instruction, to lease six "Classmate 88" calculators for one school year. One calculator was placed in each of five remedial math labs and one special education math classroom. The special education teacher and the remedial teachers were responsible for supervising and scheduling student use. Teachers were also advised concerning the security of the machine (Appendix A, page 20).

In-service instruction in the use of the machine was provided to the teachers by a representative from the Monroe Company and project procedures, design, and testing were outlined by the supervisor at the start of the program. The program was in operation officially as of September 14, 1978.

The population participating in the program consisted of all special education tenth-grade math students and the tenth grade math students (in the five-school system) who, as ninth graders the previous year, did not meet the minimum competency level in the State's math assessment (minimum basic skills) test. The

teachers were responsible for randomly selecting students from that remedial group, prior to testing, to use the calculator (the experimental group). An effort was made to have an equal number of boys and girls using the calculator, where that was feasible. (This was not feasible in two of our five schools which still have a predominantly male enrollment and in one of our schools which has a predominantly female enrollment). The final count, at the end of the year, after attrition, was 40 girls and 62 boys in the experimental group. There were 58 girls and 54 boys in the control group. The total number participating in the project, then, was 214 tenth-grade low achieving students.

Prior to using the calculator for computations, students were given a pre-test in math (the Computations section from the CTB/McGraw-Hill Comprehensive Tests of Basic Skills, Arithmetic, Form Q, Level 4) and instruction in the use of the calculator (Appendix B, page 21).

Although this CTBS Arithmetic test consists of three parts--Computation, Concepts, and Applications-- only the results of the Computation section were used, since that section most closely approximated the type of math problems that could be handled on the machine in the calculator mode.

At the conclusion of the project, students were given a post-test, using the same test, and a comparison of means was made (Appendix C, page 22).

In order to complete an interim report for January, 1979, teachers were involved in an interim survey (Appendix D, pages 23 and 24); teachers and students of the experimental group were surveyed at the conclusion of the project (Appendices E and F, pages 25 and 26).

FINDINGS

Although the teachers involved in the project started off with much enthusiasm, the problem of scheduling and the limitations of use for those students participating in the project affected that initial enthusiasm.

Students in remedial classes were scheduled for two forty-five minute periods per week. As per recommendations from the Monroe Calculator Company, students in the experimental group were scheduled for no more than 15 minutes (and in many cases less) per period on the machine. In the smaller classes, that meant that the machine was available for use to each student on an average of once every three periods; in the larger classes students were apt to be scheduled less frequently. Also, in the early stages of remediation, the machine served a more useful purpose. As students progressed, the programmed drills of the machine had to be replaced with other teaching aids more relevant to the students' needs.

For each of the six sites, the median of the total number of hours of calculator use was determined and the post-test raw scores of that half of the students above the median were averaged separately from those below the median. A comparison of the lower half and upper half for each school showed that, in five of the six cases, the students spending more time on the calculator averaged higher scores on the post-test (ranging from 1.1 to 2.7 points difference).

In the one exception (Woodbridge), some of those students with greater deficiencies had been scheduled more time on the calculator, which most probably affected the results. Even with this minus factor of 5.4, the average for all the schools combined showed a + 0.9 difference in scores in favor of the more frequent users (Appendix G, page 27).

A comparison of pre-and post- test means of raw scores for the experimental and control groups in each school, revealed that the means for the calculator users were greater in four of six cases (Appendix H, page 28).

Although a comparison of the raw score means for the total numbers of experimental and control students showed a 3.8 difference in favor of the control group, by excluding the special education students (the group which produced the lowest figures), figures were the same for both groups even though the control group in the Woodbridge school showed a plus 5.5 difference. In a

comparison of percentile averages for all the schools, there was a difference of 0.8 in favor of the experimental group and a greater difference of 3.6 in favor of the experimental group when the special education students were excluded.

Of the 102 students participating in the experimental group, 99 responded to the student survey conducted during the final days of the project. (Appendix I, page 29). Responses indicated that: (1) 98% of the students had little or no difficulty in learning to operate the calculator; (2) 75% much enjoyed using the machine; (3) 67% felt that the machine had helped them to learn math, but only 56% felt that the machine had helped them to like math more: (4) 85% preferred to use the machine rather than workbooks; (5) 81% would have liked to have used the machine more often, but only 67% would have liked to have used the machines in more ways than drills; (6) 65% felt that the machine had helped them to accomplish more in math; (7) 88% recommended continued use of the machine in math classes; and (8) 88% thought that more students should have had a chance to use the machine. The few additional comments, in addition to the ten categories surveyed, were favorable toward continued use of the calculator.

Responses to the teacher survey from the six teachers responsible for the experimental group and the one teacher who, although responsible for a control group, had assisted with teaching the experimental group, were generally favorable (86%) toward continued use of the

calculator (Appendix J, page 30). Responses to the survey form showed that: (1) 100% agreed that, once taught, students could use the machine without supervision; (2) 100% agreed that students showed a desire to use the machine and that, compared to other teaching aids , the machine was helpful to the teacher; (3) 86% said that the machine helped students to learn math and that it helped sustain student interest in drills; (4) 71% indicated they would like to use the machine in more ways (other than programmed drills). Only two reported using the machine much of the time and five reported using it "a little".

Of the two reported maintenance problems, one was covered by the maintenance/service agreement; the other, a result of student tampering, incurred a charge. Regarding the one security problem, the detachable electrical cord for one of the machines, when reported missing, was replaced, free of charge.

Some of the favorable comments expressed by the teachers included:

(1) "Students like the instant correction and wait to see their grade at the end of the exercise."

(2) "The machine has proven so successful that I would like to be able to use it with all my students."

(3) "They (the students) will work quietly and for a long time... They even enjoy taking home the tape for homework".

(4) "(The) machine was great in holding the interest of several students who could not sit still for periods of time. Students were greatly motivated by the machine and often came during their lunch time to use it."

(5) "Although the paper work was at times overwhelming, I did enjoy the use of 'Classmate 88' with my students."

(6) "I feel that next year, without restrictions, I will make good use of the machine."

(7) "The instant feedback of right/wrong (answers) and percentages worked great and improved the scores for students."

Some of the criticisms expressed included:

(1) "There is a problem with scheduling students on the machine. It is not easy to teach and keep the machine going."

(2) Students did not have a long enough opportunity to use it (particularly due to the large numbers involved in some schools).

(3) Some students were anxious for their turns on the machine and felt slighted if they could not use it.

(4) Service calls not answered promptly caused a problem in scheduling.

(5) Teachers did not find the use of the calculators to be the great timesaver it promised to be and they experienced difficulty in scheduling student use in an equitable manner.

(6) The paper work involved was felt to be "overwhelming" at times.

(7) "Many students no longer needed the programs in the machine. Forcing them to drill would have worked against ... goals."

(8) There was no strong evidence that the calculator did a better job in increasing math ability than any other instructional aid.

Budget factors to be considered include:

(1) Under the educational lease arrangement ordinary service costs are included, but if the machine were to be purchased outright, an additional cost of about $90.00 per year would be charged per machine.

(2) The machine required paper tape rolls. At a cost of about $26.00 per box of 50, this could be a large expense if the machine were to have unlimited use.

INTERPRETATION OF FINDINGS

Regarding the long-term objective of the project, "to overcome 'math phobia' and to develop an instructional method to maintain interest in drill exercises in math," the teachers all agree that this has been met. Regarding the short-term objectives, the following, according to the surveys, have been met: Students will have the feeling of accomplishment (65%); Students will have a

positive attitude toward the use of the calculator (88%); and teachers will react positively to the use of the calculator as an instructional aid (100%).

Only 56% of the students felt that the machine helped them to have a positive attitude toward mathematics. The objective concerning improvement in rote computational skills was measured by a comparison of means of raw scores and percentiles of the pre- and post-test results. Although the comparison of raw scores indicated a 3.8 difference in favor of the control group, the comparison of percentiles showed an 0.8 gain for the experimental group. Taking the scores of each individual, 85% of the students in the experimental group showed an improvement in their post-test scores compared to 86% of the students in the control group.

The differences in gain, then, are so slight as to indicate that the use of the calculator has no significant advantage over the use of any other aid in the improvement of scores.

DISSEMINATION ACTIVITIES

Despite the lack of significant gains in scores, teachers have recommended continued use of the calculator. They cite its use as an effective motivator for practice in basic computations and they recommend using the machine on a non-restrictive basis, both in its programmed mode and in its calculator mode. The educational lease for the six calculators will be renewed for next year and the special education department is considering the purchase of several for use in a resource room setting where individualization of instruction is the norm.

This report will be made available to schools upon request, and arrangements for on-site visits to view the program in operation can be arranged through the supervisor of instruction, related subjects.

STRATEGIES EMPLOYED TO ELIMINATE SEX BIAS AND SEX ROLE STEREOTYPING

It was hoped that the use of the calculators would help to overcome the tendency of females to avoid math and assist them in developing positive attitudes toward math, particularly since math is a prerequisite for many trades and, certainly, for technical areas. For that reason, teachers involved in the project were directed to include an equal number of boys and girls where feasible. Although this was not feasible in two of our male-dominant schools, an effort was made in the other schools so that, of a total of 102 students, there were 40 girls in the experimental group.

Judging from the responses to the student survey, 67% of the students felt that the calculators had, to a great degree, helped them to learn math and 23% felt it had helped at least "a little"; 56% felt that the machine had, to a great degree, helped them to like math more and 28% felt it had helped somewhat; 65% felt that the machine had, to a great degree, helped them to accomplish more in math and 27% felt it had helped somewhat. Overall, the responses were positive in students' attitudes toward the use of the machine and their feelings of accomplishment in math.

Although these calculators were restricted to remedial and special needs math classes for this project, their use as motivators could be applied in other math classrooms, particularly with females. It has been recommended to the teachers that the use of the calculators be explored further as possible instruments to overcome "math anxiety" in female students.

SUMMARY

CONCLUSIONS AND RECOMMENDATIONS

Although the National Advisory Committee on Mathematics Education (NACOME) had, in its 1975 report, called for and encouraged research and exploration in classes of the "uses of computing and calculating instruments in curriculum at all levels," teachers have been wary of using them. This opportunity for teachers to explore the use of calculators in remedial and special needs classrooms has helped to overcome some of the resistance and has opened up further possibilities for their utilization in the curriculum. Some of the uses that will be explored next year include:

(1) Continued use of the programmed mode for drill and practice in basic computations.

(2) Use of the programmed mode to generate problems of a particular type for homework assignments geared to individual needs.

(3) Use of the programmed mode for quick review of basic operations to meet individual needs.

(4) Use in the calculator mode for checking answers to word problems and problems involving more than one math operation.

(5) Use of the calculator for math enrichment and for math puzzles and games.

(6) Use of the calculator to solve involved problems of an advanced nature where the basic operations leading to a solution would ordinarily occupy a major part of the class period if they were to be solved with pencil-and-paper alone.

(7) Use of the calculator to counteract the reading difficulties of low achieving or limited English speaking students and to counteract the physical handicaps of those having difficulty in writing.

In vocational education where knowledge of math is essential in most career areas, particularly in the technical courses, instructional aids that motivate students to learn math are to be encouraged. The calculator appears to be such an instructional tool. The fact that this exploratory project did not produce significant gains in post-test scores may have been due more to the set-up of the project and the problems associated with the scheduling of students for the machine than to the actual use of the machine as an instructional

aid. Under circumstances of a more controlled nature or using a more randomly selected population, the results might have been more significant.

It is recommended that further exploration for utilizing the calculator in the cirriculum be encouraged.

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APPENDIX A

MEMORANDUM TO TEACHERS CONCERNING SECURITY OF MACHINE

TO: Remedial Math Teachers

FROM: M. McDonnell

DATE: September 14, 1978

RE: Monroe Classmate 88 Calculators

Regarding the leasing agreement we entered into with the Monroe Company:

1. Maintenance service resulting from ordinary use is provided. Contact me and I shall make arrangements to have the equipment serviced.

2. We are held responsible for loss or serious damage. Security will be your responsibility. I recommend that the machine be locked away securely when not being used or at the end of class periods. Machines should never be left out in the open in unattended or unlocked classrooms. I heartily recommend that arrangements be made with the principals to have the machines stored in the school vault (where they exist) or in a locked closet overnight, over weekends, and holidays.

   In the event of loss or serious damage, notify your principal and me immediately.

Thank you.

MMcD/lbl

APPENDIX B

RESULTS OF THE PRE-TEST IN COMPUTATIONS, BY SCHOOL

SCHOOL AND NUMBER OF STUDENTS	AVERAGE OF RAW SCORE	RANGE	AVERAGE PERCENTILE
Special Needs, East Brunswick			
Experimental - 29	11.6	1-27	3.5
Control - 27	13.6	0-25	4.3
East Brunswick			
Experimental - 14	17.9	9-31	9.8
Control - 11	19.3	8-31	12.5
New Brunswick			
Experimental - 15	20.5	12-33	13.2
Control - 12	17.8	7-30	9.8
Perth Amboy			
Experimental - 8	21.8	17-26	14.8
Control - 5	18.0	13-23	9.0
Piscataway			
Experimental - 21	23.0	14-31	15.6
Control - 40	21.9	10-34	15.2
Woodbridge			
Experimental - 15	18.5	5-28	10.7
Control - 17	19.1	11-3[illegible]	11.2
TOTAL FOR ALL SCHOOLS			
Experimental - 102	17.9	1-33	11.3
Control - 112	18.6	0-34	10.3

APPENDIX C

RESULTS OF THE POST-TEST IN COMPUTATIONS, BY SCHOOL

SCHOOL AND NUMBER OF STUDENTS	AVERAGE OF RAW SCORE	RANGE	AVERAGE PERCENTILE
Special Needs, East Brunswick			
Experimental - 29	15.3	8-28	5.3
Control - 27	17.5	8-37	10.0
East Brunswick			
Experimental - 14	26.7	15-32	18.9
Control - 11	25.9	13-38	19.9
New Brunswick			
Experimental - 15	22.5	10-35	14.4
Control - 12	21.9	11-33	13.8
Perth Amboy			
Experimental - 8	29.0	20-36	32.4
Control - 5	22.0	17-30	15.0
Piscataway			
Experimental - 21	32.8	23-44	34.3
Control - 40	28.8	13-40	25.5
Woodbridge			
Experimental - 15	21.0	6-38	12.6
Control - 17	26.5	15-40	20.5
TOTAL FOR ALL SCHOOLS			
Experimental - 102	20.6	6-44	18.3
Control - 112	24.4	8-40	17.5

APPENDIX D

INTERIM SURVEY RE "CALCULATOR PROJECT"

TO:

FROM: Marie McDonnell

DATE: November 15, 1978

Now that the Classmate 88 Calculator Project is underway, I need to know your reaction to it so that a formative, or tentative, evaluation can be done at this time to give us some direction to either continue or terminate the program. Please take time from your busy schedule to respond to the following questions and return this to me (via inter-office mail) by December 15. Thank you.

	Check One for Each Question			
	Very Much	Much	Little	Not At All
1. How difficult was it to teach the use of this machine?				
2. How difficult is it for students to use without supervision?				
3. Do students enjoy using this machine?				
4. How much does this machine help them to learn math?				
5. Has this machine helped students to like math more?				
6. Compared to other aids, is this machine helpful to you?				
7. How often is this machine used each day?				
8. Have you had maintenance problems with this machine?				
9. Would you like to use this machine in more ways?				
10. Have you had supervision or security problems with this machine?				
11. Does this machine help sustain student interest in drills?				
12. Would you like to continue using this machine next year?				

Estimate how many rolls of tape you have used with this machine to date _____

Estimate how many <u>additional</u> rolls of tape you will use this school year _____

APPENDIX D
(Continued)

Criticisms (Supporting termination of use of calculator):

Comments (Supporting continued use of calculator):

APPENDIX E

STUDENT SURVEY FORM FOR "CLASSMATE 88" PROGRAM--June, 1979

You have been identified as a student who has used the Monroe "Classmate 88" Calculator. Would you please take a few moments to answer the questions in this survey? Thank you.

(Check 1 of the 4 responses for each question)

	Very Much	Much	A Little	Not at All
1. How hard was it for you to learn to use this machine?				
2. Was this machine fun to use?				
3. Has this machine helped you to learn math?				
4. Has this machine helped you to like math more?				
5. Compared to math workbooks, would you rather use this machine?				
6. Would you have liked to have used the machine more often?				
7. Would you have liked to have used the machine in more ways than drills?				
8. Do you feel the machine has helped you accomplish more in math?				
9. Would you suggest that the machine be continued to be used in math classes?				
10. Do you think more students should have had a chance to use the machine?				

COMMENTS: (In this space or on the back, please add any comments you wish about your experience with the machine and whether you would or would not recommend its continued use)

APPENDIX F

TEACHER SURVEY FORM FOR "CLASSMATE 88" PROGRAM--JUNE, 1979

Please take a few moments to answer the questions in this survey and comment on your experience concerning the use of the "Classmate 88" as an instructional aid. Thank you.

Check one of the four responses for each question.

	Very Much	Much	A Little	Not at All
1. Once taught, were students able to use this machine without supervision?				
2. Did students show a desire to use the machine?				
3. Did the machine help students to learn math?				
4. Compared to other aids, was this machine helpful to you?				
5. How often was this machine used each day?				
6. Would you like to use this machine in more ways?				
7. Have you had maintenance problems with this machine?				
8. Have you had supervision or security problems with machine?				
9. Did this machine help sustain student interest in drills, etc.?				
10. Would you like to continue using this machine next year?				

COMMENTS:

APPENDIX G

COMPARISON OF AVERAGES OF RAW SCORES OF 102 CALCULATOR USERS ACCORDING TO TOTAL TIME USED

Note: For each school, the median of the total number of hours of calculator use was calculated and the post-test raw scores of that half of the students above the median (upper half) were averaged separately from those below the median (lower half).

	AVERAGE OF POST-TEST RAW SCORES	DIFFERENCE
SPECIAL NEEDS, EAST BRUNSWICK		
Lower half (3 hours or less)	15.2	
Upper half (more than 3 hours)	17.9	+2.7
EAST BRUNSWICK		
Lower half (9 hours or less)	25.9	
Upper half (more than 9 hours)	27.1	+1.2
NEW BRUNSWICK		
Lower half (1.2 hours or less)	21.9	
Upper half (more than 1.2 hours)	23.0	+1.1
PERTH AMBOY		
Lower half (3.5 hours or less)	29.4	
Upper half (more than 3.5 hours)	31.9	+2.5
PISCATAWAY		
Lower half (3.1 hours or less)	31.7	
Upper half (more than 3.1 hours)	34.0	+2.3
WOODBRIDGE		
Lower half (2 hours or less)	23.7	
Upper half (more than 2 hours)	18.3	-5.4 *
TOTAL FOR ALL SCHOOLS		
Lower half	23.5	
Upper half	24.4	+0.9

*In every case, but Woodbridge, students spending more time on the calculator averaged higher scores on the post-test. In the case of Woodbridge, the fact that some of the students with the greater deficiencies were scheduled more time on the calculator most probably affected the results.

APPENDIX H

COMPARISON OF PRE- AND POST- TEST RESULTS BY SCHOOL

SCHOOL AND NUMBER OF STUDENTS	AVERAGE RAW SCORE		RANGE		AVERAGE PERCENTILE	
	PRE-TEST	POST-TEST	PRE-TEST	POST-TEST	PRE-TEST	POST-TEST
Special Needs, East Brunswick (*Mean score of experimental groups is the same or greater than control group in post-test.)						
Experimental - 29	11.6	15.3	1-27	8-28	3.5	5.3
Control - 27	13.6	17.5	0-25	8-37	4.3	10.0
East Brunswick						
Experimental - 14	17.9	26.7*	9-31	15-32	9.8	18.9
Control - 11	19.3	25.9	8-31	13-38	12.5	19.9
New Brunswick						
Experimental - 15	20.5	22.5*	12.33	10-35	13.2	14.4*
Control - 12	17.8	21.9	7-30	11-33	9.8	13.8
Perth Amboy						
Experimental - 8	21.8	29.0*	17-26	20-36	14.8	32.4*
Control 5	18.0	22.0	13-23	17-30	9.0	15.0
Piscataway						
Experimental -21	23.0	32.8*	14-31	23-44	15.6	34.3*
Control - 40	21.9	28.8	10-34	13-40	15.2	25.5
Woodbridge						
Experimental - 15	18.5	21.0	5-28	6-38	10.7	12.6
Control - 17	19.1	26.5	11-31	15-40	11.2	20.5
TOTAL FOR ALL SCHOOLS						
Experimental - 102	17.9	20.6	1-33	6-44	11.3	18.3*
Control - 112	18.6	24.4	0-34	8-40	10.3	17.5
Total, Excluding Spec. Nds.						
Experimental - 73	20.5	26.6*	5-33	6-44	12.8	22.5*
Control - 85	20.2	26.6	7-34	11-40	11.5	18.9

APPENDIX I

RESULTS OF STUDENT SURVEY FORM FOR "CLASSMATE 88" PROGRAM--
June, 1979

Ninety-nine (99) students surveyed.

	Very Much	Much	A Little	Not at All
1. How hard was it for you to learn to use this machine?	2		32	65
2. Was this machine fun to use?	48	26	23	2
3. Has this machine helped you to learn math?	40	26	27	6
4. Has this machine helped you to like math more?	31	24	28	16
5. Compared to math workbooks, would you rather use this machine?	55	29	11	4
6. Would you have liked to have used the machine more often?	62	18	16	3
7. Would you have liked to have used the machine in more ways than drills?	38	28	25	7
8. Do you feel the machine has helped you accomplish more in math?	37	27	27	8
9. Would you suggest that the machine be continued to be used in math classes?	61	26	9	3
10. Do you think more students should have had a chance to use the machine?	61	26	9	3

APPENDIX J

RESULTS OF TEACHER SURVEY FORM FOR "CLASSMATE 88" PROGRAM--
June, 1979

Seven (7) teachers were surveyed.

	Very Much	Much	A Little	Not at All
1. Once taught, were students able to use this machine without supervision?	2	5		
2. Did students show a desire to use the machine?	4	3		
3. Did the machine help students to learn math?	2	4	1	
4. Compared to other aids, was this machine helpful to you?	3	4		
5. How often was this machine used each day?		2	5	
6. Would you like to use this machine in more ways?	4	1	2	
7. Have you had maintenance problems with this machine?			2	5
8. Have you had supervision or security problems with machine?			1	6
9. Did this machine help sustain student interest in drills, etc.?	2	4	1	
10. Would you like to continue using this machine next year?	5	1		1

COMMENTS: Note: The one special-needs teacher who indicated that she would not continue using the machine next year made the comment that she enjoyed using it and that "Several have been purchased for use...in a resource room setting... "The checking of the "Not at All" category is due to a change next year in procedures for the utilization of the machine.